CHAPTER 6: SHADOWS

A. INTRODUCTION

According to the *CEQR Technical Manual*, a shadow is defined as the circumstance in which a building or other built structure blocks the sun from the land. An adverse shadow impact is considered to occur when the shadow from a proposed project falls on a publicly accessible open space, historic landscape, or other historic resource if the features that make the resource significant depend on sunlight, or if the shadow falls on an important natural feature and adversely affects its use and/or important landscaping and vegetation. In general, shadows on city streets and sidewalks or on other buildings are not considered significant under CEQR. In addition, shadows occurring within one and one-half hours of sunrise or sunset generally are not considered significant under CEQR.

The *CEQR Technical Manual* suggests that a significant shadow impact may occur under the following situations:

- Significant reduction in sunlight where a sensitive use is already subject to substandard sunlight (i.e., less than the minimum time necessary for survival);
- Reduction in sunlight available to a sensitive use to less than the minimum time necessary for its survival;
- Significant reduction in sunlight to a sun-sensitive use or feature; or
- Significant reduction in the usability of the open space.[1]

The uses and vegetation within an open space resource determine its sensitivity to shadows. Uses that rely on sunlight include passive uses, such as sitting or sunbathing, and such activities as gardening or wading in fountains or pools. Vegetation requiring sunlight includes the tree canopy and flowering plants. In open spaces where lawns are actively used, the grass also requires extensive sunlight. For these activities and plants, 4-6 hours a day of sunlight is generally a minimum requirement, particularly in the growing season.[2] Sun-sensitive features of historic resources may include large windows admitting light into interior spaces, stained glass windows in churches, deeply sculpted facade ornamentation, and historic landscapes.

This chapter assesses the reasonable worst-case development scenario, on a site-specific basis, for potential shadowing effects on existing light-sensitive resources. The proposed project includes the rezoning of an area that includes approximately 70 acres of land (currently zoned for light manufacturing use) and zoning text amendments to facilitate the creation of the Dutch Kills Subdistrict (an extension of the Special Long Island City Mixed- Use District) and to establish Inclusionary Housing. DCP has identified 40 projected development sites considered most likely to be developed by 2017 as a result of the proposed action. In addition, there are approximately 230 potential development sites considered less likely to be developed in the foreseeable future. Building heights on projected and potential development sites would range from 70 to 125 feet in portions of the re-zoning area.

[1] *CEQR Technical Manual*, p. 3E-19.
[2] *CEQR Technical Manual*, p. 3E-9.

B. OVERVIEW

The Proposed Project would cast incremental shadows on the southern portion of Dutch Kills Playground, a publicly accessible open space located immediately north of the rezoning area. However, no sunlight sensitive uses such as sitting, sunbathing, gardening, or wading in fountains or pools, were identified at the playground within the potential shadow radius of the Proposed Project. Triangle Forty-One, a publicly accessible open space which does contain sunlight sensitive uses, was determined to be outside the shadow radius of the projected and potential development sites under the Future Condition with the Proposed Actions. Finally, one outstanding publically accessible open space with potential sunlight sensitive uses in the form of five benches was determined to be within the potential shadow radius of the projected and potential development sites under the Future Condition with the Proposed Actions. This site, Triangle Thirty-Seven, a publically accessible open space located at the southwest corner of 37th Avenue and Northern Boulevard, will be the focus of the following shadow analysis and discussion.

C. METHODOLOGY

For the purposes of the shadow analysis, a maximum shadow study area (study area) was defined through the screening procedures as set forth in the *CEQR Technical Manual*. The screening procedure notes that the longest shadow that any structure could cast during the year is equal to 4.3 times its height at the beginning and end of the December 21 analysis period when shadows are cast to the northwest and northeast, respectively. Toward midday, as the sun rises in the sky, the shadow length factor is reduced to 2.07 times the height of the building. This 4.3 shadow factor was applied independently to all projected and potential sites with expected building heights of greater than 50', via the use of buffers in ARC-GIS software.[3] For example, the projected and potential development sites with expected building heights of 70 and 125 feet yielded study area radii of approximately 301 and 538 feet, respectively.

In coordination with Chapter 5, "Open Space", and Chapter 7, "Historic Resources", publicly accessible open spaces and architectural resources to the north, south, east, and west of the projected and potential development sites were identified, as shadows created by the proposed action could fall in the direction of these resources. Publically accessible open space and historical resources with sunlight sensitive features that would be out of the shadow range of the projected and potential sites were eliminated from further analysis. Based on this shadow screening, three sites with potentially sunlight sensitive resources were identified within the potential shadow radius of the projected and potential development sites under the RWCDS. As detailed in the following section, two of these sites were found to be ineligible for further analysis leaving one outstanding site warranting further consideration.

To aid this final analysis, a three-dimensional ("3-D") computer model was used to prepare the shadow figures and tables in order to assess the impact of incremental shadows from the Proposed Project on sunlight-sensitive resources in one outstanding sensitive site known as Triangle Thirty-Seven. Based on Map Pluto 2006 GIS data for the Queens Borough in conjunction with 3-D software, a model has been prepared for this sensitive site and surrounding shadow inducing buildings across existing, Future Condition without Proposed Actions and Future Condition with Proposed Actions. This 3-D model is the basis for all figures and tables which represent the nature and extent of potential shadow impacts to Triangle Thirty-Seven.

[3] Copyright © 1995-2006, ESRI (Environmental Systems Research Institute, Inc.)

D. RESOURCES OF CONCERN

OPEN SPACES

DUTCH KILLS PLAYGROUND

Dutch Kills Playground is generally bound by 36th and 37th Avenues to the north and south, respectively, and 28th Street and Crescent Street to the east and west, respectively. Dutch Kills Playground is 2.4 acres in size and is the largest open space resource in the vicinity of the Proposed Project.[4] This publically-accessible open space, maintained by the New York City Department of Parks and Recreation ("NYCDPR"), lies partially within the shadow study area. Only the southern portion of the playground lies within the potential shadow radii of the projected and potential development sites. As discussed in Chapter 5, "Open Space", the playground offers both passive and active recreation areas and features a baseball diamond, a hockey rink with an electronic scoreboard, two basketball hoops, playground equipment, handball courts, and a sitting area. The majority of the playground is covered with asphalt. A small area containing trees and landscaping is present in the central portion of the playground. Sunlight sensitive features in Dutch Kills Playground include the playground equipment, sitting area, landscaping, and trees. These sunlight sensitive features, however, are all located on the northern end of the playground, and are located outside the projected shadow radii. As such, no further shadow analysis was performed for the Dutch Kills Playground.

TRIANGLE FORTY-ONE

Triangle Forty-One is located at the southeast corner of 41st Avenue and 29th Street. The triangle is 0.028 acres in size and does not offer seating or passive recreation. As seen in Figure 6-1, the triangle is landscaped with four small trees. These trees have been identified as Kwanzan cherry trees.[5] Kwanzan cherry trees enjoy full sun but can survive in partial shade. Further shadow analysis of Triangle Forty-One is discussed below.

TRIANGLE THIRTY-SEVEN

Triangle Thirty-Seven is located at the southwest corner of 37th Avenue and Northern Boulevard. As seen in Figure 6-1, the triangle offers well maintained landscaping and some small trees. These trees have been identified as honeylocusts.[6] These species are shade tolerant and are prevalent in New York City living under conditions of limited sun.

A small area located across Standard Lane from Triangle Thirty-Seven offers five benches. According to Map Pluto data, the area across Standard Lane is not maintained by NYCDPR. The parcel is not assigned a tax lot. For the purposes of this chapter, this area will be referred to as Segment one of Triangle Thirty-Seven as it contains the benches and is most immediately affected by future conditions under the proposed project; and the aforementioned Triangle Thirty-Seven proper will be referred to as Segment two, located eastward of Segment one. Further shadow analysis of both segments of Triangle Thirty-Seven is contained in the following discussion of the Future Condition with the Proposed Actions.

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[4] <http://nycgovparks.org/sub_your_park/historical_signs/hs_historical_sign.php?id=220>, accessed 1/29/08.
[5] Based on email correspondence with New York City Parks Department.
[6] Ibid.

TRIANGLE FORTY ONE

TRIANGLE THIRTY SEVEN

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Dutch Kills Rezoning and Related Actions

Shadow Analysis Potential Sensitive Sites

The Louis Berger Group, Inc.

Figure 6-1

HISTORIC RESOURCES

Based on the *CEQR Technical Manual*, historic resources with sunlight-dependent features (such as stained glass windows or historic landscapes) should be considered in shadow analyses. These resources included properties or districts listed on the S/NR (or found to be eligible for such listing), National Historic Landmarks (NHLs), and New York City Landmarks (NYCLs) and Historic Districts, and properties determined eligible for landmark status. As detailed in Chapter 7, "Historic Resources", there are ten individual historic properties and one historic district (with five buildings identified) determined to be eligible for listing in the State and National Registers; and of these, three were deemed eligible for NYCL designation.. These historic resources were assessed for their potential to be sunlight sensitive. It was determined that none of the eligible historic resources had sunlight dependent characteristics or features that made the resource subject to a shadow review under *CEQR* guidelines. As such, no further shadow analysis was performed for these historic resources.

E. FUTURE CONDITION WITHOUT THE PROPOSED ACTIONS

As detailed in Chapter 2, "Project Description," in the future condition without the proposed actions, given the current zoning and existing land use trends, it is anticipated that new, as-of-right development would occur on the development sites in the rezoning area. In addition, there are ~~nine~~ several known development projects expected to be completed in the rezoning area by 2017 which are proposed as hotels with construction either underway or currently being planned.

As per the *CEQR Technical Manual* and discussed in the methodology section above, a 4.3 shadow factor was applied to each of these development sites via the use of buffers in ARC-GIS software. Based on this analysis, it was determined that none of the open space resources discussed above are within the potential shadow radius of the background development sites. As such, no further shadow analysis for background sites was conducted and no significant adverse shadow impacts will occur under the Future Condition without the Proposed Actions scenario.

F. FUTURE CONDITION WITH THE PROPOSED ACTIONS

The future condition with the proposed actions scenario has identified 40 projected and 192 potential development sites that could be realized under within the rezoning area. (see Chapter 2, "Project Description"). The vast majority of the development sites would introduce residential buildings ranging in height from 33 feet, found primarily in the interior mid-blocks, to 125 feet along the blocks bordering Northern Boulevard.

The sun rises in the east and casts its earliest (and longest) shadows to the west. Later in the morning, the sun rises higher in the sky, casting shorter shadows towards the northwest. At noon, the sun is at its highest point in the sky and casts the shortest shadows of the day directly north (During Daylight Savings Time, this occurs at 1:00 PM rather than at noon). In the afternoon, the sun continues to move west and begins to descend, casting longer shadows toward the northeast and east. At the end of the day, just before the sun sets in the west, shadows are slightly shorter than just after sunrise.

In its yearly cycle, the height of the sun in the sky and the time and directional location at which it rises and sets varies by season. In the winter, the sun travels in a low arc across the southern sky, rising late in the southeast and setting early in the southwest. Because it is so low in the sky, it casts longer shadows. In the spring and fall, the sun arcs through the sky at a somewhat higher angle, rises earlier in the east,

and sets later in the west. In these seasons, shadows are of moderate length. In the summer, the sun arcs through the sky at its highest angle, rising almost directly overhead at noon. For this reason, summer shadows are shortest. However, in the summer, the sun rises earliest and sets latest; it also travels farther, from the northeast to the northwest. Thus, the summer sun with its late sunset and early sunrise casts shadows for a longer duration of time than the other months.

Based on the shadow screening detailed above, Kwanzan cherry trees within Triangle Forty-One and the series of benches located across from Triangle Thirty-Seven proper were identified as sunlight sensitive resources within the potential shadow radius of projected and potential development sites under the Future Condition with the Proposed Actions. As such, further analysis is warranted to determine the potential for significant adverse shadow impacts to these resources.

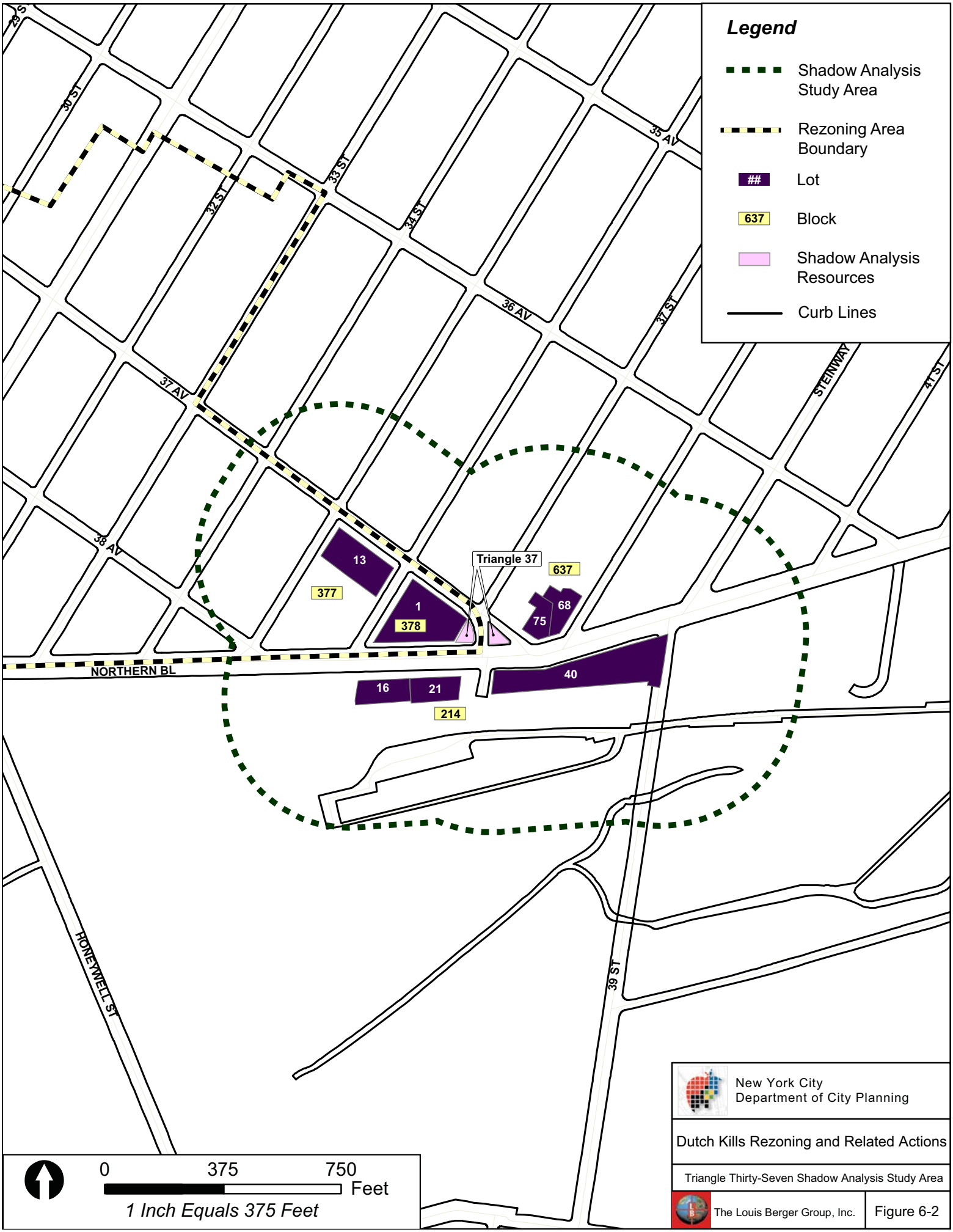
TRIANGLE FORTY-ONE

Because of the path that the sun travels across the sky, no shadow can be cast in a triangular area south of any given facility. As per the *CEQR Technical Manual*, if the open space is located in that triangular area, no assessment of shadows is required. In New York City, that is the area between 108 degrees east of true north and 108 degrees west of true north. Triangle Forty-One lies at approximately 108 degrees west of true north from the southeast corner of Projected Site #3 (Block 402; Lots 32, 35, 12). As such, the open space is just within the potential shadow radius of this projected development site.

By using the Table 3E-1 of the *CEQR Technical Manual*, it was determined that the maximum shadow length factor of Projected Site #3 is 3.66 on June 21st. ~~Shadows generated at the other dates suggested by the *CEQR Technical Manual*, May 6th, March 21st, and December 21st, would fall within the triangle described above~~ Shadows generated at the other dates suggested by the *CEQR Technical Manual*, May 6th, March 21st, and December 21st, would fall within the triangle described above wherein further shadow assessment is not required. As Triangle Forty-One does contain deciduous trees which are particularly susceptible to shadows during the months of April through May—the growing season as defined by *CEQR guidelines*— shadows during the May 6th and March 21st dates could potentially result in adverse impacts. However, as noted, these analysis periods are not applicable to Triangle Forty-One as occur within the southern triangular area of no shadow impact. Given that the projected building heights on the site are 125 feet, the length of the shadow on June 21st will be 3.66 times 125 feet, or 457.5 feet from the southeast corner of the projected development site. Triangle Forty-One is approximately 595 feet from the southeast corner of the projected development site and as such is not within the shadow cast on June 21st. Given its location, Triangle Forty-One and the trees contained within would not receive shade from Projected Development Site #3. Based on this information, no significant adverse shadow impact to Triangle Forty-One will occur as a result of the Proposed Project.

TRIANGLE THIRTY-SEVEN

Triangle Thirty-Seven, located in the northeastern section of the rezoning area, is bisected by the project's rezoning area boundary at the corner of 37th Avenue and Northern Boulevard. As seen in Figure 6-2, the triangle is surrounded by seven lots that feature potentially shadow inducing buildings under the ~~either the RWCDS or the~~ Future Condition without the Proposed Action. Note that the existing building heights on these seven lots will remain the same under the Future Condition without the Proposed Action scenario. As such, the analysis that follows will only refer to the Future Condition without the Proposed Action and not existing conditions.



Source: MapPluto, NYCDP.

These buildings have been modeled in 3D software—the basis for the shadow analysis to follow—detailing the bulk and height of the buildings across both existing and the Future Condition with the Proposed Actions. Within the triangle itself both publically accessible vegetative areas and benches are present; Figure 6-3 notates the exact location of these open space resources relative to the immediate buildings and the boundaries of Triangle Thirty-Seven. The western component of the triangle is approximately 0.065 acres, referred to in the following shadow analysis as segment one. To the immediate east, the eastern component of the triangle is approximately 0.036 acres, referred to respectively as segment two.

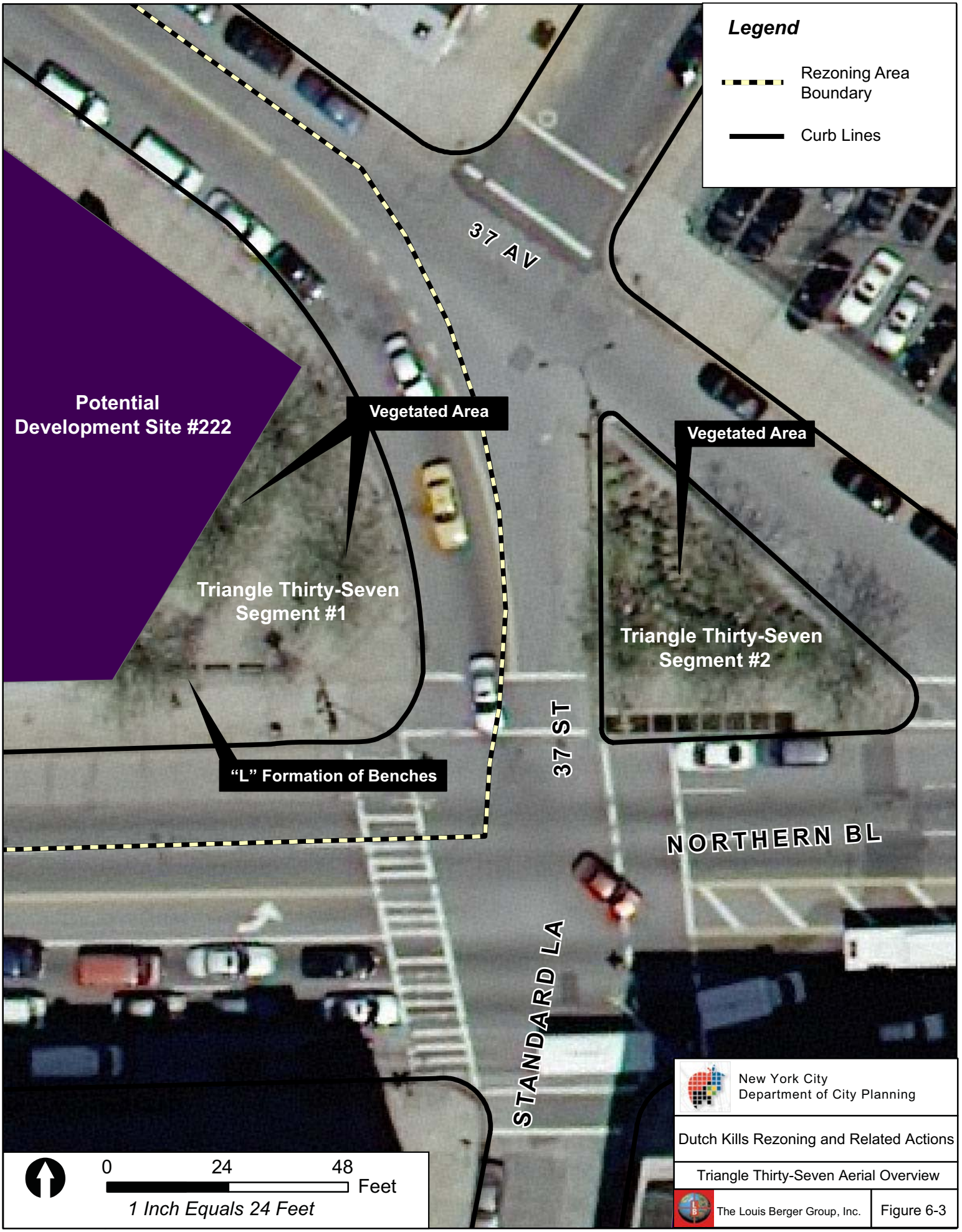
Located within Triangle Thirty-Seven, segment one contains five benches which are arranged in an "L" formation in the southwestern portion of the triangle. The western-most bench is located less than 35 feet from the eastern edge of the existing building atop the adjoining parcel (Block 378, Lot 1; Potential Development Site #222). The building footprint takes up the entire parcel under the existing conditions. For the shadow analysis that follows, it was assumed that the building to be constructed on the potential development site will also occupy the entire parcel. In other words, the footprint of the existing building was used for the shadow analysis with the exception that the anticipated height of the potential building was used in place of the existing height.

Under the Future Condition with the Proposed Actions, Potential Development Site #222 would result in new shadow periods from mid-morning to the latest possible time of shadow penetration as allowed under *CEQR* guidelines. The details of these new shadow periods for segment one and segment two are notated in Table 6-1 and 6-2, respectively. As seen in a comparison of these tables, the difference between the shadow periods resulting from the existing building and those of Potential Development Site #222 are relatively negligible. Specifically, the Future Condition with the Proposed Actions ~~the RWCDS~~ detailed in Table 6-1 would result in an increase of 20 to 40 minutes in the duration of shadows over the existing and Future Condition without the Proposed Actions in three analysis periods—March 21st, May 6th and June 21st.

The exception to this modest increase in the duration of shadows resulting from Potential Development Site #222 occurs during the December 21st analysis period wherein shadows from both the existing building and the future Potential Development Site #222 do not enter Triangle Thirty-Seven segment one or segment two at all. Rather, both segments experience prolonged shadow coverage resulting from the existing eastward buildings atop Block 214, lots 40 and 21. Here shadows are present from the earliest analysis time on December 21st to the latest analysis time; that is, from 8:45 a.m to 3:00 p.m.

As depicted in Figures 6-4 through 6-7, shadow coverage resulting from Potential Development Site #222 begins ~~mid-morning~~ early ~~mid~~ afternoon ~~-morning~~ at the western edge of segment one (1), and ~~early afternoon~~ in the evening at the western edge of segment two (2). This shadow penetration continues throughout the afternoon and evening, concluding at the latest possible analysis time for all analysis dates except December 21st. During the December 21st analysis period, shadows cast from eastward existing buildings begin at the earliest analysis time (8:45 a.m.) and continue throughout the afternoon towards the latest analysis time (3:00 p.m.) with windows of partial shadow penetration occurring from 8:45 a.m. to ~~12~~3:15 p.m.

In all analysis periods, the duration and extent of shadow penetration is extensive, and often exceeds *CEQR* guidelines for sensitive sites. However, these shadows are largely the result of existing buildings that are not anticipated to change under the Future Condition with the Proposed Actions. The one exception to this finding occurs at the inception of shadow penetration on March 21st, May 6th and June



Source: MapPluto, NYCDP.

21st wherein the earliest analysis time period begins 20 to 40 minutes earlier than in the existing and the Future condition without the Proposed Actions.

Table 6-1 Triangle Thirty-Seven | Segment 1*

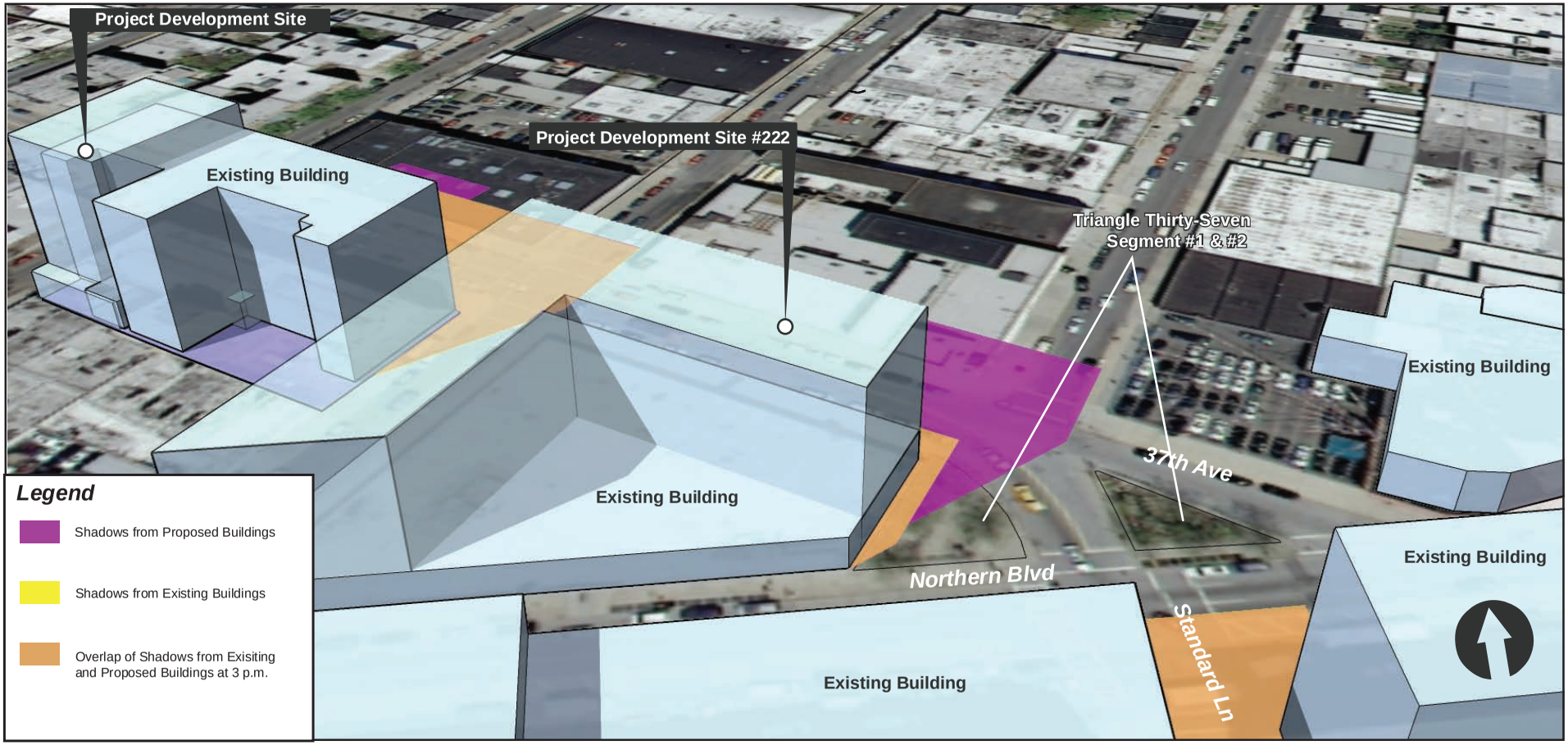
Analysis Period	**March 21: 8:27 a.m. – 5:40 p.m.**
Sunrise/Sunset	6:57 a.m./7:10 p.m.
Duration of shadow (due to Proposed Project)	4 hours
Times of shadow penetration	1:40 p.m. – 5:40 p.m.
Maximum Increment	9%
Affected features	Park Benches in southern section of Segment 1; vegetated portions of Segment 1.
Analysis Period	**May 6: 7:18 a.m. – 6:28 p.m.**
Sunrise/Sunset	5:48 a.m./7:58 p.m.
Duration of shadow (due to Proposed Project)	5 hours, 28 minutes
Times of shadow penetration	1 p.m. to 6:28 p.m.
Maximum Increment	3%
Affected features	Park Benches in southern section of Segment 1; vegetated portions of Segment 1.
Analysis Period	**June 21: 6:55 a.m. – 7:00 p.m.**
Sunrise/Sunset	5:25 a.m./8:30 p.m.
Duration of shadow (due to Proposed Project)	6 hours
Times of shadow penetration	1 p.m. – 7:00 p.m.
Maximum Increment	13%
Affected features	Park Benches in southern section of Segment 1; vegetated portions of Segment 1.
Analysis Period	**December 21: 8:46 a.m. – 3:01 p.m.**
Sunrise/Sunset	7:16 a.m./4:31 p.m.
Duration of shadow (due to Proposed Project)	6 hours, 15 minutes
Times of shadow penetration	8:46 a.m. – 3:01 p.m.
Maximum Increment	0%
Affected features	Park Benches in southern section of Segment 1; vegetated portions of Segment 1.

* This table has been modified to reflect revised analysis for the FEIS.

Table 6-2 Triangle Thirty-Seven | Segment 2*

Analysis Period	**March 21: 8:27 a.m. – 5:40 p.m.**
Sunrise/Sunset	6:57 a.m./7:10 p.m.
Duration of shadow (due to Proposed Project)	1 hour, 40 minutes
Times of shadow penetration	4:00 p.m. – 5:40 p.m.
Maximum Increment	166%
Affected features	Honeylocusts trees.
Analysis Period	**May 6: 7:18 a.m. – 6:28 p.m.**
Sunrise/Sunset	5:48 a.m./7:58 p.m.
Duration of shadow (due to Proposed Project)	2 hours, 58 minutes
Times of shadow penetration	3:30 p.m. to 6:28 p.m.
Maximum Increment	368%
Affected features	Honeylocusts trees.
Analysis Period	**June 21: 6:55 a.m. – 7:00 p.m.**
Sunrise/Sunset	5:25 a.m./8:30 p.m.
Duration of shadow (due to Proposed Project)	3 hours, 23 minutes
Times of shadow penetration	3:37 p.m. – 7:00 p.m.
Maximum Increment	351%
Affected features	Honeylocusts trees.
Analysis Period	**December 21: 8:46 a.m. – 3:01 p.m.**
Sunrise/Sunset	7:16 a.m./4:31 p.m.
Duration of shadow (due to Proposed Project)	6 hours, 15 minutes
Times of shadow penetration	8:46 a.m. – 3:01 p.m.
Maximum Increment	0%
Affected features	Honeylocusts trees.

* This table has been modified to reflect revised analysis for the FEIS.



Sources: Map Pluto, NYCDCP, 2005; USGS Ortho Quad # 2, Central Park, NY, 2006.

** This figure has been modified for the FEIS to include the correct shadow positions based on Eastern Standard Time .*

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Incremental Shadows From Proposed Project
March 21st, 3:00 p.m.

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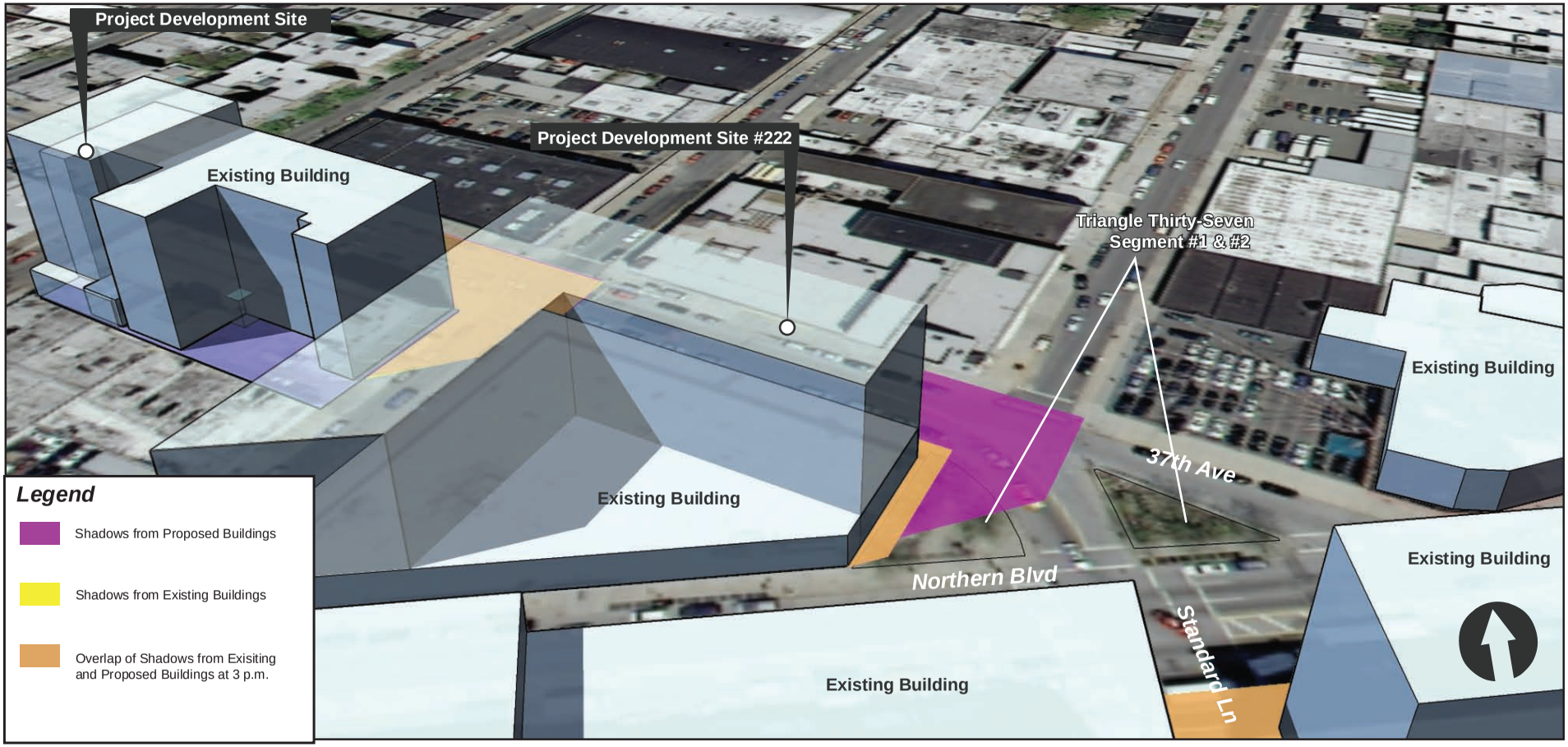
Figure 6-4



Sources: Map Pluto, NYCDCP, 2005; USGS Ortho Quad # 2, Central Park, NY, 2006.

** This figure has been modified for the FEIS to include the correct shadow positions based on Eastern Standard Time .*

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Dutch Kills Rezoning and Related Actions

Incremental Shadows From Proposed Project
May 6th, 3:00 p.m.

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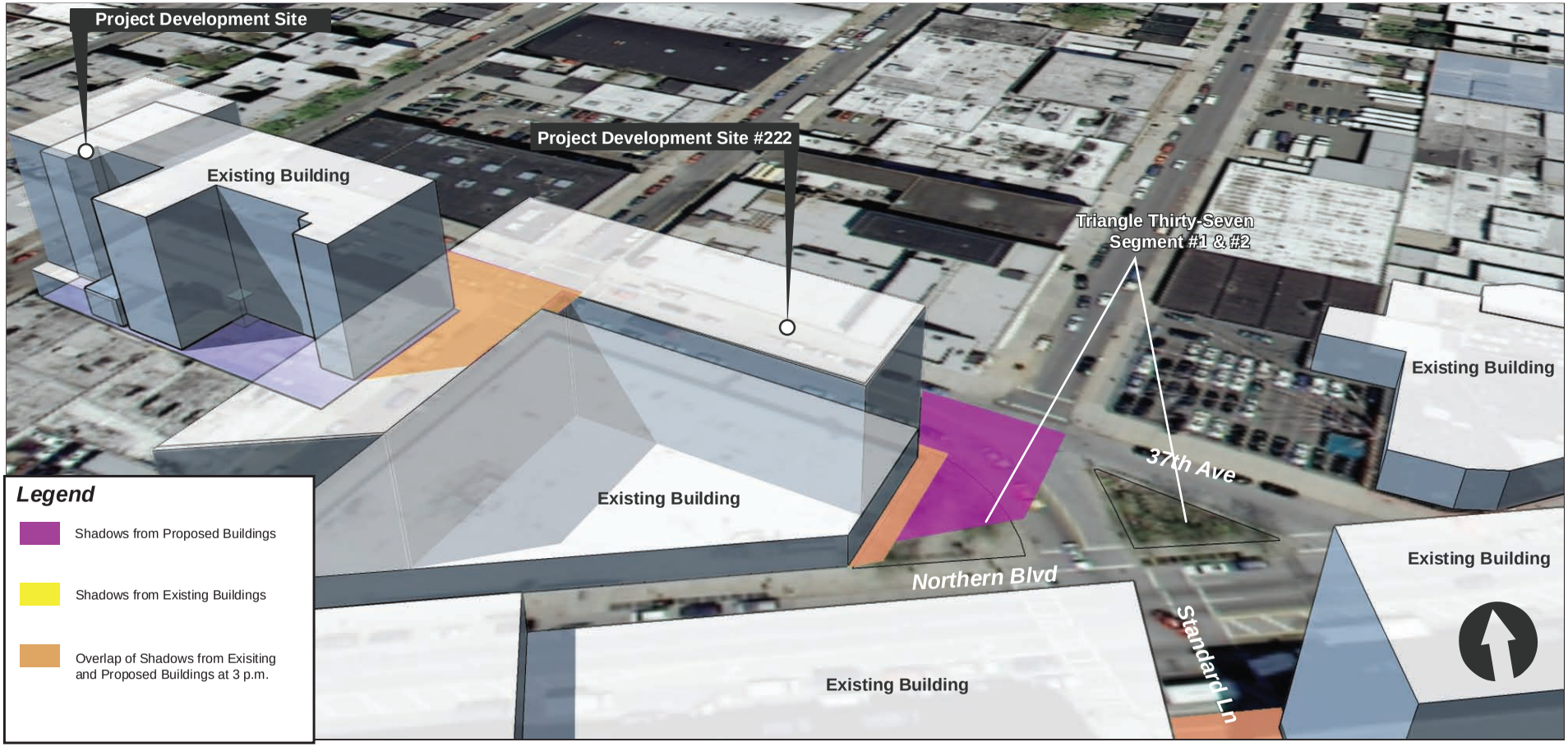
Figure 6-5



Sources: Map Pluto, NYCDCP, 2005; USGS Ortho Quad # 2, Central Park, NY, 2006.

** This figure has been modified for the FEIS to include the correct shadow positions based on Eastern Standard Time .*

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Dutch Kills Rezoning and Related Actions

Incremental Shadows From Proposed Project
June 21st, 3:00 p.m.

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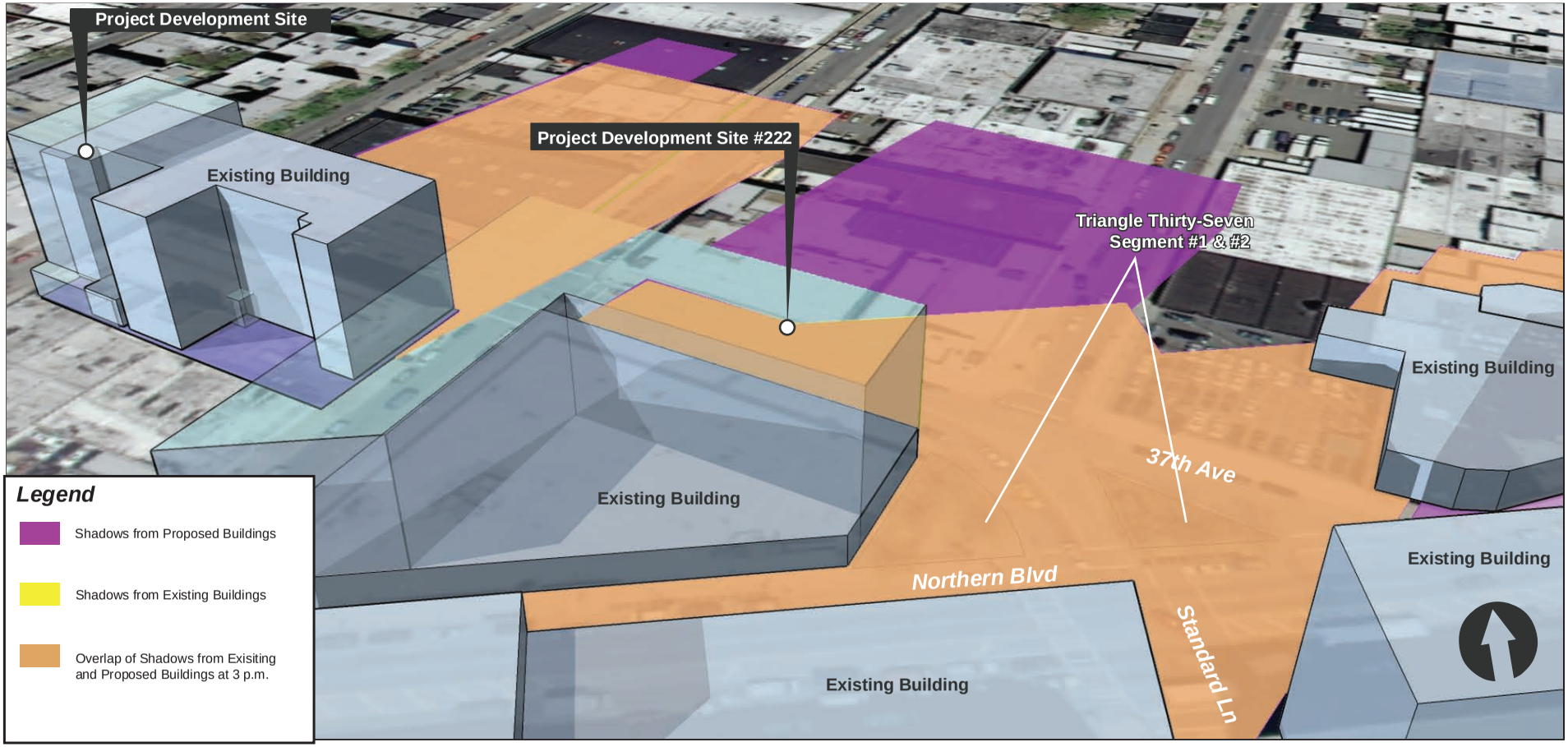
Figure 6-6



Sources: Map Pluto, NYCDCP, 2005; USGS Ortho Quad # 2, Central Park, NY, 2006.

** This figure has been modified for the FEIS to include the correct shadow positions based on Eastern Standard Time .*

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Dutch Kills Rezoning and Related Actions

Incremental Shadows From Proposed Project
December 21st, 3:00 p.m.

The Louis Berger Group, Inc.

Figure 6-7

G. CONCLUSION

The Proposed Project would not result in significant adverse shadow impacts to the noted resources of concern. Under ~~The~~ the Future Condition with the Proposed Actions ~~RWCDS~~ the Proposed Project would cast incremental shadows on the southern portion of Dutch Kills Playground, a publicly accessible open space located immediately north of the rezoning area. However, no sunlight sensitive uses were identified at the playground within the potential shadow radius of the Proposed Project. Triangle Forty-One, a publicly accessible open space which does contain sunlight sensitive uses, was determined to be outside the shadow radius of the projected and potential development sites under the Future Condition with the Proposed Actions. The Future Condition with the Proposed Actions ~~RWCDS~~ would cast incremental shadows across Triangle Thirty-Seven, a publicly accessible open space located at the southwest corner of 37th Avenue and Northern Boulevard. However, these shadows are negligible in comparison to those found under the Future Condition without the Proposed Actions. Specifically, the RWCDS would result in an increase of 20 to 40 minutes in the duration of shadows over the Future Condition without the Proposed Actions in three analysis periods—March 21st, May 6th and June 21st. The exception to this modest increase in the duration of shadows resulting from the Future Condition with the Proposed Actions ~~the RWCDS~~ occurs during the December 21st analysis period wherein shadows from both the Future Condition with the Proposed Actions ~~the RWCDS~~ and the Future Condition without the Proposed Actions do not enter Triangle Thirty-Seven segment one or segment two at all. During this analysis period, both segments experience prolonged shadow coverage resulting from the existing eastward buildings atop Block 214, lots 40 and 21. Here shadows are present from the earliest analysis time on December 21st to the latest analysis time; that is, from 8:45 a.m to 3:00 p.m.

Given that shadows under existing conditions cover Triangle Thirty-Seven at or near 100 percent during substantial portions of the shadow analysis periods, the increase in the duration of shadows under the Future Condition with the Proposed Actions ~~RWCDS~~ when compared to the Future Condition without the Proposed Actions would be negligible. Therefore, as the preceding shadow analysis results indicate, the incremental shadows resulting from the Proposed Project would not have a significant adverse effect as defined by *CEQR* guidelines for the following reasons: no significant reduction in sunlight has been found where a sensitive use is already subject to substandard sunlight; sunlight reaching the affected sensitive sites would not be reduced to less than the amount of time necessary for plant survival and the usability of the affected sensitive sites would not be substantially compromised.